ABSTRACT

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This study focuses on modeling people's perceptions of places and how those

perceptions are affected by cultural differences. Cultural background affects the way

people feel and recall information. However, it is unclear how cultural background

influences individual's perception of geospatial areas such as a town or a city. One

way an individual's cultural background varies is with regard to the patterns of one's

routine communication. This concept is described by Hall's high- and low-context

cultural model (1976). The ways people perceive geospatial places can be

characterized in terms of their tendency to rely on specific landmarks or symbolic

addresses. In this study, we use an online survey and an online place recognition

game to test the hypothesis that high-context individuals will perceive urban places in

terms of landmarks rather than symbolic addresses. The results suggest that high- and

low-context is not a unified construct. Instead it is a multi-dimensional construct with

sub-dimensions where one of those, i.e. one's attitude towards other's communication

style, may affect an individual's perception of places.

"I KNOW WHERE THAT IS": CULTURAL DIFFERENCES
IN PERCEPTION OF PLACES

By

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Chapter 1: Introduction

Today, many people in the world immigrate, travel, work, and study internationally. When they arrive at a new place, people often face difficulties arising from social, cultural, and economical differences. These general issues are further complicated because newcomers are unfamiliar with the new environment. Not only must they adjust to a new culture and society, but also they must do so while learning about a new place. It is not a simple process to become accustomed to a new place because it involves acquiring local information and getting used to the place. These difficulties have been previously identified in several research fields. In the library and information science (LIS) literature, immigrants' information seeking was described as a very complex process (Caidi, et. al., 2010). Newcomers' access and use of information in a new environment has been characterized as vulnerable and uncertain (Lingel, 2011). In addition to these information problems, newcomers frequently undergo psychological and cognitive hardships (Kirmayer, et. al., 2011; Bernstein, et. al., 2011). They are easily distracted by the unfamiliar geospatial structure of a new environment (Ng, 1998). This phenomenon was further supported by the study that showed Americans who relied on grid pattern of a city frequently felt frustration, when attempting to navigate in locations that used different systems (Hall, 1969).

Other studies have focused on understanding newcomers' information strategies to learn about new places. One study reported about immigrants' information tactics such as using the Internet or wandering around a new place

(Lingel, 2011). She found that most frequently mentioned information sources among immigrants were the Internet and friends, and other resources such as school, neighbors, and family were also reported as important information sources. Oh and his colleagues furthered the study focusing on new international students' information seeking behavior (Oh, et. al., 2014). This study reported that newly arrived international students heavily relied on their friends from same countries of origins to learn about new places. The study also found that Internet-based geo-tagged tools were essential for new international students in adjusting to new places.

As abovementioned studies showed, Internet-based tools about geospatial information have been playing an important role recently for newcomers, and usually called as geo-local systems. Geo-local systems, a type of social computing systems using geospatial information, have been suggested as means to deal with newcomers' difficulties of learning about new places in the context of Computer-Supported Cooperative Work and Human-Computer Interaction. The term 'geo-local system' has been used in various literatures such as Geography, Information Management, and Electrical Engineering. Both in Information Management and Geography, the term 'geo-local' focused on the feature of tagging geographical data on pictures or SNS (Stephens, 2012; Ishida, 2012). In the Electrical Engineering field, the concept of geo-local systems was even more biased to technical characteristics of the underlying computing system (Marines, et. al., 2010). Meanwhile, relevant information systems have been introduced in different domains. In Transport Policy, for example, Advanced Travel Information Systems (ATIS) has been suggested to enhance travelers' time and cost effectiveness (Grotenhuis, et. al., 2007).
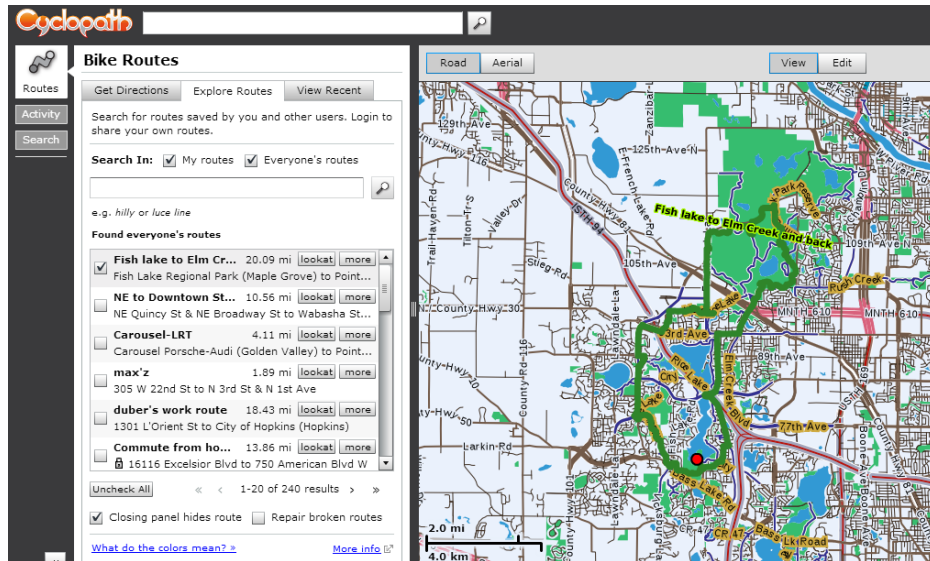
Figure 1. A Screenshot of Cyclopath (http://www.cyclopath.org).

In the Computer-Supported Cooperative Work field, the concept of Geographic

Volunteer Work (GVW) was suggested to emphasize people's voluntary information

sharing behaviors in geo-local systems (Priedhorsky, et. al., 2010). In this thesis, we

use the term 'geo-local system' to connote both the technical features that people can

tag geographical data on pictures or SNSs, and GVW aspects. By doing so, the term

would be able to be defined as social computing systems that allow users to find, use,

and produce local information based on geographical data.

A well-known example of a geo-local system is Cyclopath, designed by

Priedhorsky and his colleagues as shown in Figure 1 (Priedhorsky, et. al., 2010). This

system resolves bicyclers' paths finding issues by making use of a crowdsourcing

strategy. It is now successfully deployed and used in many cities in the United States.

Another tool that was designed to help people seek and use local information was

Whoo.ly: a web application for finding neighborhood information from Twitter.

Whoo.ly has been developed and studied to provide local information such as events,

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people, and places in a more convenient way than Twitter. (Hu, Farnham, & Monroy-Hernandez, 2013).

It is possible that these types of geo-local systems can be beneficial not only to local citizens, but also to newcomers in seeking and acquiring information about locations and places. Facilitating the process of becoming familiar with an area would be helpful for newcomers adapting to new places and culture. However, for the efforts to create geo-local systems that are useful for newcomers to be successful, the information strategies and interface designs must take into account how people understand geospatial places. If their perceptions of a place differ in some ways, the efforts to resolve the issue of newcomers would be able to further benefit more people by considering the knowledge.

Differential perception of places has been studied in Geography and Experimental Psychology. Environmental perception processes vary according to people's backgrounds, and these differences lead to differing ways of interacting with places (Holloway & Hubbard, 2001). Therefore, it has been suggested that human behavior regarding geospatial places needs to be understood in relation to people's partial, distorted, and simplified understanding of the surroundings (Kirk, 1963). Specifically, Gold argue that patterns of human activity can be effectively understood by studying their perceptions (Gold, 1980). Since users' activities in geo-local systems vary significantly just like those in the real-world, it would be important to understand how people's perceptions of places can be modeled so that it can be used in designing geo-local systems and information strategies.

Various factors have been studied in the context of Geography suggesting that people's perceptions of their geospatial environment differ according to their reasons to be in particular places as well as their psychological development (Holloway & Hubbard, 2001). Newcomers' reasons for being in a place can be identified relatively easily since people usually have purposes such as vacation, business, or study when going to a new place. The relationship between newcomers' reasons for being in a place and their perceptions of the place has been studied in several research areas. For example, researchers from Tourism Research studied how perceptions of places varied between residents and tourists (Garrod, 2008). Psychological development, on the other hand, comprises of very complex processes that involve many features such as national identity and childhood experience. Furthermore, it is difficult to trace how it affects people's understanding of a specific environment.

Among those many potential factors, cultural background is expected to be one of the most important concerns in terms of designing geo-local systems (Barber & Badre, 1998; Chau, et. al., 2002). For example, researchers in HCI found that interface design considering cultural features was able to enhance user performance on web-based systems (Barber & Badre, 1998). Cultural background is a representative criterion to categorize users in social computing systems, and geographers also emphasize that perception of an environment acquires values in cultural contexts (Kirk, 1963). Furthermore, there have been much evidence that cultural background matters in recall and recognition of information (Kim, 2013). Geo-local systems are mostly web-based systems that have web-oriented features such as hyper-links, images, and interacting methods, which are similar to other

social computing systems. At the same time, it is closely related to people's psychological development, thus cultural background can be hardly overlooked in designing geo-local systems (Holloway & Hubbard, 2001).

In this work, therefore, we focus on how people's perceptions of places can be modeled, and how those perceptions are affected by cultural differences. If immigrants or visitors from China and Germany come to Washington D.C., for example, they normally investigate the area for a period of time to get familiar with the city. During this period, do they perceive the area differently because of their different cultural backgrounds? If so, how does cultural background affect their encountering and processing information during this time of adaptation? Answering these questions would inform our understanding of how individuals adapt to new urban areas, allowing city planners, software developers, and researchers to better design information resources and systems for visitors and newcomers.

In the following chapters, we first explore relevant models of cultural background and spatial perception in prior studies. Then, a model relating cultural background and perception of places is described, and a specific hypothesis regarding this relationship is presented. Subsequently, we show the design of an experiment designed to test the proposed hypothesis and explore the research questions. Finally, we present results of the experiment and analysis, and discuss the implications and limitations of this study.

Chapter 2: Literature Review

In this chapter, we first introduce the concept of 'space' and 'place' to distinguish the two terms, so as to clarify the meaning of the term 'place.' Then, we review studies that have considered the relationship between cultural background and human perception in general. This review provides a basis for understanding how cultural groups have been classified and what kinds of general perceptions have been previously examined. Then, several cultural models are compared to provide background for the cultural model chosen for this study. Finally, concepts of geospatial places are reviewed to model people's perceptions of places.

2.1. Space and Place

In the Computer-Supported Cooperative Work (CSCW) literature, the term 'space' means Euclidean structure comprised of shapes or colors. The concept of 'place' includes not only three-dimensional structure, i.e., 'space,' but also recognizable and persistent traits that provide cultural and social meanings (Dourish, 2006). This means that describing a place always involves characterizing people's understanding of the space, and perception of a place depends on both structural and human factors. Thus, when the terms 'space' and 'place' are referred to, they follow the CSCW concepts. In following sections, this concept is used to articulate the meaning of people's perceptions of places.

In an early study of people's perceptions of spaces in cultural contexts, Hudson (1960) administered people from different tribal origins in Africa and educational backgrounds. He examined how they perceived pictures of spaces either as 2D or 3D space, and found that their understandings of spaces differed by their educational backgrounds, not by cultural backgrounds (Hudson, 1960). In Information Science, recent cross-culture studies have found that cultural background influences the way people feel and think about objects (Kim, 2013). Kim (2013) reported that the ways people perceived information of an advertisement varied when their cultural backgrounds differed. That is, Korean students recognized information from an image-oriented advertisement better than American students.

Several studies in Cognitive Psychology and Consumer Research have focused on languages, which are closely related to culture (Jiang, 2000), as a factor affecting people's spatial perception and visual memory (Hermer-Vazquez, et. al., 2001; Schmitt, Pan, & Nader, 1994). Specifically, Hermer-Vazquez's team (2001) found that individual's language production skills played an important role in spatial recognition: the better one's language production skill was, the better he or she recognized a space. Also, Chinese-speakers were found to be better at recalling written or visual brand names than English-speakers (Schmitt, Pan, & Nader, 1994). Taken together these studies suggest that cultural background is a significant factor in how people perceive, think about, and recall the world around them. Yet from this prior work, it is unclear how cultural background influences individuals' perceptions

and information behaviors regarding a geographic area, such as a town or neighborhood.

One interesting point to notice is that most cultural studies of perception have classified subjects based on nationality regardless of their conceptual models of cultural background. Cultural models have been mostly used to explain the features of each country's people as a whole, but not to explain differences among subjects themselves. This is one of the issues that this study tries to deal with, since nationality-oriented explanations neglect people's diverse cultural traits that come from other factors such as education, personal experiences, or psychological development (Holloway & Hubbard, 2001). By examining various cultural models, it would be able to better understand the strengths and weaknesses of alternative models.

2.3. Cultural Models

Many cultural models have been suggested in diverse research fields. Among them, models having relatively concrete features are briefly summarized in Table 1. Highly abstract definitions of culture (e.g. Herskovits, 1955; Rokeach, 1973) were omitted from this table, since they were too abstract to be materialized, and the quantifying processes for those concepts were beyond the scope of this study. One of the early work on cultural model is Murdock's universal cultural values (Murdock, 1965). He listed universal cultural traits including dancing, education, music, and other well-known values, which were thought to be universal across the globe.

Table 1. Summary of Cultural Models

Model	Key Features	Strength	Weakness
Hofstede's cultural dimensions (Hofstede & Minkov, 2010)	• Power distance • Individualism/ Collectivism • Uncertainty avoidance • Masculinity/ Femininity • Long-term orientation • Indulgence/ Self-restraint	• Covers diverse aspects of culture • Easy to operationalize one's cultural background based on his/her nationality	• Focused only on nationality • Data based on limited people from each country (i.e. IBM employees)
High- and low-context cultural model (Hall, 1976)	• The degree of information explicitness in the coded part of messages	• Communication is common practices for most people • Covers diverse aspects of culture	• Difficult to operationalize the model
Seven-dimensional cultural model (Turner & Trompenaars, 1993)	• Universalism/ Particularism • Individualism/ Collectivism • Neutral/Affective relationships • Specific/Diffuse relationships • Achievement/ Ascription • Internal/External control • Perspectives on time	• Enhanced Hofstede's cultural dimensions, so it includes more diverse concepts such as relational aspects	• Focused mainly on nationality and problem solving
Subjective culture (Trandis, 2002)	• Categories • Category associations • Beliefs • Attitudes • Norms • Roles • Tasks • Values • Value orientation	• Efficient way to understand a specific group and compare two groups • Not limited to specific groups of people	• Covers too broad concepts of culture • Hard to measure due to people's different perspectives toward shared values (Trandis, 2002)
Universal cultural values (Murdock, 1965)	See Appendix A	• Make it easy to compare any two countries • Provide diverse cultural values	• Not enough justification for each cultural trait

| Value Orientations (Kluckholn, 1961) | • Human nature (e.g. evil or good)
• Human-nature relationship (e.g. subjugation or harmony)
• Human-human relationship (e.g. Lineal or hierarchical)
• Temporal focus (e.g. past, present, or future)
• Action orientation (e.g. appreciation of experience or accomplishment) | • Not limited to specific groups of people | • Limited to values while culture may contain other aspects such as problem solving (Straub, et. al., 2002)
• Some items are too abstract to be used (e.g. human nature) |

However, these observations has not been further developed as a systematic model to justify and evaluate each value.

Other cultural models such as subjective cultural model (Trandis, 2002; Trandis, 1972) and value orientations model (Kluckholn, 1961) also provide insights about how cultural can be modeled and classified. Especially, Trandis' (2002) subjective cultural model describes a general approach to study people's cultural background in order to make it simple and economic. Even though, these models deal with too many concepts at the same time, and this makes it difficult to use the models directly, but researchers still need to narrow it down to a concrete model.

A widely used model is Hofstede's cultural model (Hofstede & Minkov, 2010) which was initially developed in 1980s and has been refined over time (Hofstede, 1980; Hofstede & Minkov, 2010). It defines six factors to explain cross-national differences based on surveys for IBM employees from 70 countries (Hofstede & Minkov, 2010). This model provides measurable profiles for each

country based on the dimensions. While Hofstede's model is useful because it allows subjects to be easily categorized based on nationality, it has limitations. The initial data are likely to be biased due to the subject population, i.e. IBM employees. This model had been further developed by Turner and Trompenaars (1993). Their seven-dimension cultural model tried to cover more diverse aspects of culture such as relationships among people (Turner & Trompenaars,1993).

Despite the refinements, the abovementioned models of culture have mainly focused on identifying and operationalizing nationality-oriented features, but do not touch on individual-level traits such as personal characteristics. Since cultural background is a multi-dimensional construct that cannot be determined by one's nationality and individuals from a same country can have significantly different cultural traits, there should be more general, all-compassing metric that considers not only nationality-level values, but also other human features (Straub, et. al., 2002). Moreover, those models assume that identified values exist throughout people from most countries and groups. Lastly, because these models were developed as general frameworks for characterizing national-level differences, how and if they might relate to individuals' perceptions of their geospatial environment.

Hall's high- and low-context cultural model has the potential to avoid these limitations. Hall's model is not limited to one's nationality, but instead considers various features such as communication style, time dimensions, place dimensions, and relationships while providing concrete concepts (Hall, 1976; Hall, 1990). Hall's high- and low-context cultural model describes individual's cultural backgrounds as they relate to the degree of information explicitness in people's routine

communication. Specifically, high-context individuals usually assume that the social and physical context contains most of the relevant information, leading to very little of information to be included in the coded part of the message (Hall, 1976). In Korea where people are thought to be high-context, for example, it is common that people do not think they know about a man even if they have talked to him for a while. It is only after acquiring peripheral information such as one's walking style, appearance, friend relationships, or voice tone that they feel comfortable about the person. Low-context individuals, on the other hand, tend to make fewer assumptions about the general availability of information, leading to messages in which more of the relevant information is explicitly presented (Hall, 1976). Since those contexts are highly intertwined with place, time, and other people an individual faces every day, the model suggests that high-/low-context backgrounds are likely to affect variety of perceptual, recall, and cognitive processes, including those related to geospatial environments.

If we have reasonable measures or protocols that can determine each individual's cultural features, Hall's model would be able to have more advantages. There have not been many attempts to measure high- and low-context cultural background. Most studies about high- and low-context culture assumes that Asian countries are high-context and western countries are low-context (Kim, 2013; Herseman & van Greunen, 2011). Only Oddou and Derr (1999) tried to operationalize the model in their management book, but it has not been validated through empirical studies (Oddou & Derr, 1999). Thus, we validated and modified the protocol, so that we can properly measure people's cultural background based on Hall's model.

Physical or pictorial presentations of a place can be modeled in various ways. As mentioned in a previous section, distinction between 2-dimensional and 3-dimensional spaces is one way to characterize differences in how people perceive a space (Hudson, 1960), but this construct is limited to modeling pictorial presentations of a space. In Geography, Kirk (1963) modeled place as an objective, real, field or as a subjective, behavioral field (Kirk, 1963). Objective/real field means only a physical world, while subjective/behavioral field denotes psychophysical place in which patterns of the place are restructured through individual's psychological perceiving processes (Kirk, 1963; Holloway & Hubbard, 2001). This was a good starting point to characterizing places, but it remained abstract: it did not provide concrete concepts about how perceived places could be further classified (Holloway & Hubbard, 2001).

An alternate conceptualization of spatial perception based on the concept of landmarks has been suggested in Information Science literature. Landmarks are defined as prominent and identifying features in a geospatial area, providing an individual with a mean for locating oneself (Sorrows & Hirtle, 1999). The concept of landmarks has been mainly used in way-finding studies, and was frequently featured as cognitive objects that facilitate navigational performance in a geospatial area (Etienne, et. al., 1999; Duckham, et. al., 2010; Tom & Denis, 2004). This means landmarks play an important role in people's recalls and perceptions of geospatial spaces through being added subjective meanings by individuals. In other words, landmarks are geospatial objects that involves people's subjective feelings and

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activities, and this concept is very similar to the notion of places which is introduced in section 2.1 (Dourish, 2006). It is because Dourish's definition of place also includes both 3-dimensional structural characteristics and human activities.

Sorrows and Hirtle (1999) furthered the idea of landmarks, and studied how landmarks were memorable and meaningful to people. In this study, they characterized landmarks with three features: visual, cognitive, and structural ones. According to the authors, visual landmarks are objects that are salient because of their memorable visual characteristics such as Eiffel tower's steel-framed design in Paris. Cognitive landmarks are objects in which the meaning is prominent. For example, a resident advisor's room would be perceived as an important place to students even if the room looks same to students' rooms in a dormitory. Lastly, structural landmarks are places where their roles or locational characteristics are dominant in the structure of the environment. Dupont Circle in Washington D.C. can be an example of structural landmarks since it has its unique role as the intersection that is connected with other important places such as foreign embassies (Sorrows & Hirtle, 1999). These characterizations of landmarks along with Dourish's (2006) concept of place make it more precise in modeling geospatial places that are to be perceived and referenced by people. In other words, it is not only visually salient buildings that give rise to people's perceptions of places, but also structurally or individually meaningful geospatial objects, and all those kinds of places can be modeled as landmarks.

Another alternative to landmarks is street names. Street names have been contrasted to landmarks as cognitive entities in urban environment in Cognitive Psychology literature, and particularly in wayfiniding studies (Tom & Denis, 2004;

Streeter, et. al., 1985). Street names are also known to be memorable and meaningful to people as cognitive objects in geospatial places (Tom & Denis, 2004). A difference between landmarks and street names is at how people retrieve and recall each entity from perceived places. Since street names are relatively difficult to be retrieved from spatial structure, they are likely to accompany less visual memory (Tom & Denis, 2004). On the other hand, landmarks would tend to be retrieved with more visual memory.

Meanwhile, there were conflicting studies about perceptions and memories toward landmarks and street names. Streeter's team (1985) and Bahrick (1983) reported that street names were more easily forgotten and harder to be perceived than landmarks, while Kalakoski and Saariluoma (2001) indicated that some populations such as taxi drivers might have better memory about street names. This remains people's characteristics about memory and perception of geospatial places unclear.

Moreover, prior studies on landmarks and street names focused primarily on people's procedural wayfinding processes. Tom and Denis (2004) examined people's wayfinding performances when they were given route instructions with landmarks and street names in a city. The results showed that people were more accurate in finding ways when they were given landmarks, but this did not indicate how people perceive places.

Prior studies' conflicting results and different focuses on landmarks and street names raise a question on how people's perceptions would vary based on their backgrounds. If respondents recognize a place as a 'spatial structure' or an 'image',

they would perceive it as a landmark. In the case that they do not perceive it as a spatial image, they might remember it with a street name.

Considering the abovementioned concepts and models, the research question can be restated as follows:

RQ1: How does individual's perception of places relate to their cultural background?

- **RQ1-1: How does individuals' use of landmarks to refer to places relate to the degree to which their cultural background is with a high-/low-context culture?**

- **RQ1-2: How does individuals' use of symbolic references (i.e. street names) to recall and refer to places relate to the degree to which their cultural background is high-/low-context?**

Chapter 3: Hypothesis

High-context culture assumes that physical, social, or environmental context of the communication such as mood, appearance, or gesture contains much of the relevant information. This leads to people's uses of implicit or less information-laden messages. On the other hand, low-context culture assumes that information is less likely to be available in the physical or environmental context, so messages among people in the culture tend to be explicit and more information-laden.

From the literature about landmarks and street names, meanwhile, landmarks tend to be retrieved from people's visual memory. Street names, on the other hand, are more likely to be recalled just like other kinds of proper names such as the names of individuals (Tom & Denis, 2004). Since visual memory and spatial structure are related to the physical context that people from high-context culture highly rely on, it is expected that high-context individuals will be more likely to use landmarks to recall and reference geospatial places. In the same way, low-context individuals will be less likely to rely on visual aspects of objects in recall and recognizing objects, since they tend not to acquire information from physical or environmental context.

As mentioned in section 2.2, moreover, prior studies of visual memory suggest that people from Asian countries tend to recall information as visual form, while western countries recall it as a text form (Hermer-Vazquez, et. al., 2001; Schmitt, Pan, & Nader, 1994). Even though country-level measures are less effective in understanding individuals' cultural background, the studies support the hypothesis derived from the literature review.

H1: High-context individuals would tend to perceive places as landmarks rather than symbolic address (i.e. street names), while low-context individuals would in the opposite way.
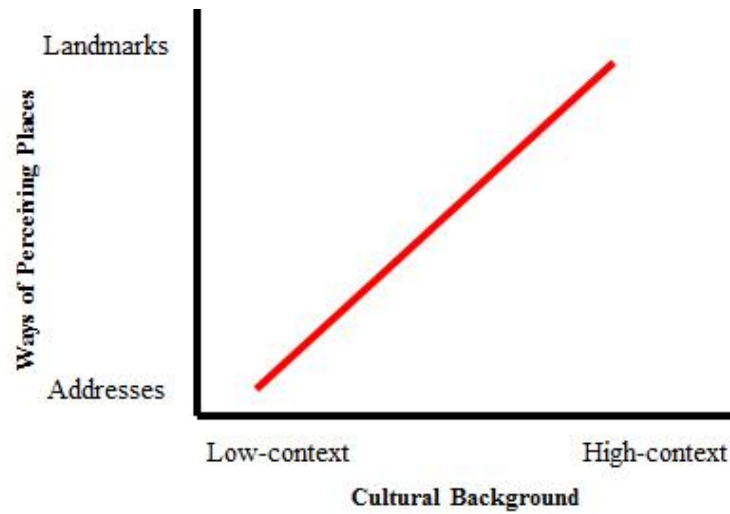
Figure 2. Hypothesized relationship between cultural background and perception of places.

Chapter 4: Study Design and Methods

In order to test the hypothesis and explore the impact of cultural background on individuals' perceptions of places, quantitative methods were used. We use two approaches to examine the relationship between the cultural background (i.e. high-/low-context culture) and ways of perceiving places (landmarks vs. symbolic address). An online survey was used to determine whether individuals are high- or low-context and a web-based game was used to assess whether they are more likely to perceive places as landmarks or in terms of street names.

As with any methods, there are limitations to adopting quantitative methods for this study. First, this approach can limit the opportunities to identify factors other than high- and low-context that might characterize relevant aspects of individuals' cultural backgrounds. Similarly, the construct used to model subjects' perception of places might not be effective for identifying the expected cognitive aspects of spatial perception. These issues could be addressed in future work using qualitative approach. Another issue is that the web-based approaches may be biased if people tend to behave differently when completing a web survey (Bargh & McKenna, 2004). However, the web-based methods have advantages with respect to sample size, sample heterogeneity, and cost-effectiveness compared to lab-oriented approaches (Reips, 2000). Since this study focuses on testing the hypothesis, but not on identifying other possible factors affecting people's cultural backgrounds and perceptions, the quantitative approach is most appropriate in terms of enhancing statistical power and reliability of the empirical study.

4.1. Web-based Game

4.1.1. Background

One important thing for this study is to operationalize people's perception of places in terms of whether they recognize them as landmarks or symbolic addresses (i.e. street names). However, the assessment of how people perceive a place must be done in a way that does not impose a particular conceptual model in the process of solving the technical issues that arise with presenting places. Thus, the goal of the experiment platform was to measure people's perception of places by showing places to people without biasing their responses, while making it scalable to a large number of people and places.

Quercia and his colleagues designed a web-based game called 'UrbanOpticon,' which was developed for and demonstrated to work as a basis for quantitatively assessing perception of places (Quercia, 2013)[1]. Figure 3 shows the screenshot of UrbanOpticon. In his paper, he examined Londoners' ability to recognize London's streets. This platform allows for quantification of people's perceptions of places. It contains basic mechanisms and procedures that specify how different places can be consistently shown to people, and how their answers can be stored in the database. Furthermore, the researchers successfully conducted a research about people's ability to recognize places by recruiting a large number of people through the platform. We have made use of the platform in quantifying people's perceptions by making changes in its algorithms and database structure to adapt it of measuring people's perception of places in terms of landmarks and/or street names.
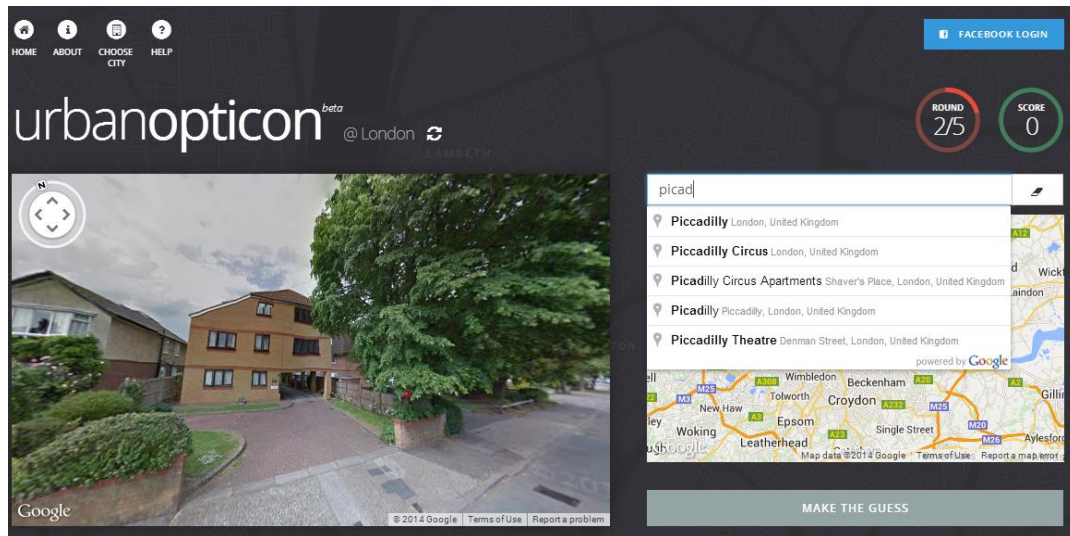
Figure 3. A Screenshot of UrbanOpticon (http://www.urbanopticon.org).

4.1.2. Design Concerns and Rules

The main concerns in designing the game were quantifiability, randomization of quizzes (to minimize learning effects), and measurement of both sides of human knowledge: correctness and answer type. Quantifiability and randomization of the game were achieved by adopting the basic code structure of UrbanOpticon, which will be discussed in the section 4.1.3. Measurement of correctness and answer type was achieved by creating design rules. Correctness refers to whether people accurately identified a place when shown a picture of it. This measure indicates people's actual knowledge of the place. Answer type is either landmark or street names. This measure is an indicator of how people perceive places in terms of whether they recognize places as visual/spatial structures or symbolic entities. Multiple-choice quizzes were used to assess these measures. Limiting user's flexibility in answering questions, force them to choose either landmarks or street names. The multiple-choice options were randomly presented so as to minimize

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undesirable order effects. Lastly, photos used in the game were screen so that they did

not contain any text that people might use to identify the location. For example, if a

photo shows Route 1, the "Route 1" sign was omitted from the photo. By doing so,

we can prevent participants' answers from being distorted by photos.

4.1.3. Interface Design Process

In UrbanOpticon (Quercia, et. al., 2013), subjects play a quiz game in which

they are shown a series of photos of London streets and asked to identify them by

typing in where each place is. Participants can answer the questions in three different

ways: borough-based, tube (metro station)-based, and "don't know." The answer

form was open-ended and players were helped by an auto-complete function when

they typed in the answer. Upon finishing the survey, respondents are asked to provide

basic demographic information such as gender and age. The researchers measured

subjects' ability to recognize locations and compared it to their demographic

information based on the extra survey and IP addresses.

For our study, the UrbanOpticon game was modified so that it followed the

design rules outlined above. In the first prototype of the game, each photo was

accompanied by a question with five answer options. One of the options was "don't

know", and the others included two landmarks and two street name answers. A

sample screen from the first version game is shown in Figure 4.

Figure 4. A screenshot of the first draft of the web-based game.

However, there were several issues with this design. If a subject did not know about the place, he or she would choose "don't know" option. Conversely if they thought they knew the location, they would select one of the other answers. However, beyond this binary distinction (thought they knew vs. thought they didn't know), it was not possible to determine how confident individuals were about their ability to identify the location. Furthermore, because of the structure of the answer set the rate that an individual by chance answers a question correctly was high (50%), adding additional noise to the study's measure of correctness. With this design, there

was no way to determine whether subjects guessed the answer or exactly knew the place, and this ambiguity created confusion when interpreting the data.

After an expert review of the first version the game design was modified to include conditional questions. For each question, players are first asked to indicate how familiar they were with the place using a 7-point Likert-type scale (1 = 'do not know at all' to 7 = 'know very well'). After answering the familiarity question, they are directed to another question for the same place asking where it was. This question presented them with six options: three landmark options and three street name options. One option from each category was the correct answer. By providing two correct options and four wrong options, the rate that an individual by chance chooses a correct answer was reduced. Also, it was possible to interpret the results more precisely with the analysis of whether people's perceptions of places is actually based on their knowledge or not.

4.1.4. Content

The sample for this study is people from different cultures living in and around the city of College Park, MD. The target area is determined due to the convenience of recruiting participants, the availability of culturally diverse population (due to the presence of a major university) and the bounded nature of the location and community. The size and bounded nature of the city allows us to identify a set of locations that it is likely many potential participants might recognize. This helps us focus on how people remember and perceive places within the town rather than on people's ability to recognize them.

When playing the web-based game, participants were shown a series of photos from the target area's streets and asked to indicate where each place was. Twenty places were picked for the study, and fifteen photos of these places were randomly presented to each subject. The photos are drawn from Google Street View, which provided a way to present places while keeping the quality of the photos consistent. Also, this allows researchers to apply the study to other cities in the future. The specific locations used in the game are presented in Appendix B.

4.1.5. Implementation

The web-based game has been implemented based on UrbanOpticon, since it has been open to public for research purpose.[2] The application is basically developed using PHP, JavaScript, jQuery, Ajax, and MySQL server. Also, it makes use of Google Street View's APIs, Facebook application APIs, and other web utilities. Additional logics for new features such as conditional questions and multiple-choice answers have been added to the basic code structure, and the database schema has been modified accordingly. The last page of the game has been implemented to pass the user ID to Qualtrics site, so that the survey data about cultural background can be linked to the game data. The reason that the quiz game has been placed prior to the survey is to facilitate its quantifiability. The gamification of the study is originally intended to populate the website through participants' voluntary sharing of their scores. It would have been difficult to benefit from this design if the game were placed after the survey.

After the second version of the game had been built, it was tested and reviewed by HCI professionals who are faculty members at the University of

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Maryland. New issues identified included instructions for users on how the score system works; instructions about how users can pan a photo picked from Google Street View; the size of buttons for better usability. In order to deal with these, a short instruction about the scoring mechanism has been added in the front page, and the size of buttons has been enlarged so that it is salient to users. Also, the size of the aggregated score bar and progress bar have been enlarged. Finally, a short message has been added at the top of the photo area, denoting that it was possible to pan around each scene. The final version of the game is shown in Figure 5.

4.1.6. Measure

Raw data collected from the game are stored in the database. The database schema is shown in Figure 6. Basically, once a user begins the game, a record in the *users* table is automatically created with default identifiers: the user's location and a unique user ID randomly generated in the system. The location can be acquired by making use of IPInfoDB API[3], which can approximately estimate a user's physical location based on the user's IP address. Users' location data are only used to see if subjects are living near the target place, and not used in the analysis. When they answer each question, answers are stored in the *answers* table. One record of the *answers* table shows only one of the three types of answers: landmark, street names, or familiarity. The design of the database is inefficient in terms of using the data storage, but has an advantage in maintaining the game. The example of collected data is shown in Table 2.

(a) A question about the familiarity of a place.

(b) A question about the perception and the correctness of a place.

Figure 5. A screen shot of the final version web-based game.
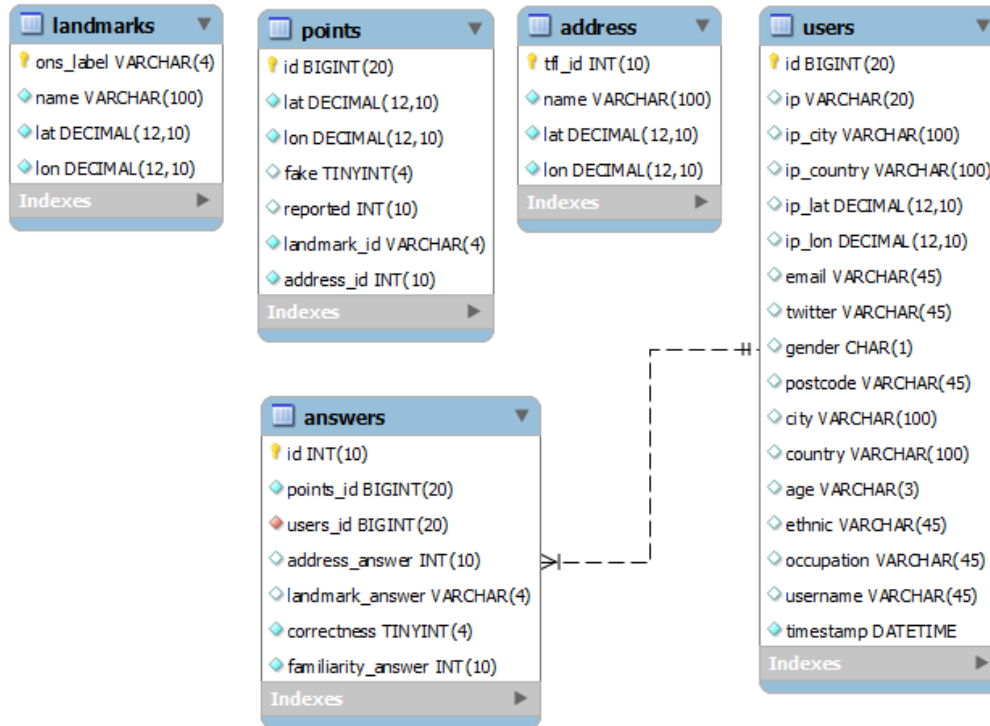
Figure 6. The database schema of the web-based game.

These answers are then reorganized into user-based form so that data can be analyzed in per-user basis. Since data transformation process was complicated and difficult to do with a spreadsheet program, simple Python scripts have been developed to organize the data. The scripts are available in a Github repository for future uses.[4] An example of the organized data is presented in Table 3. Important measures in this study include the rate of landmark answers, familiarity score, and so on, which are mostly presented in the table. Other than the measures, user ID is passed to the survey that is implemented in Qualtrics.[5] Since the web game and the survey do not share a common database, IDs have to be passed from the game to Qualtrics so as to identify each subject.

Table 2. An example of raw data of the web-based game

ID	Point ID	User ID	Street name Answer	Landmark Answer	Familiarity Answer
293	17	285			7
294	17	285		h	
295	2	285			1
296	2	285	0		
297	1	285			1
298	1	285		i	
299	18	285			1
300	18	285		a	
301	15	285			4
302	15	285	12		
303	12	286			1
304	12	286		m	

Table 3. An example of organized game data

User ID	Number of Answers	Number of Landmark Answers	Number of Street Name Answers	Number of Correct Landmark answers	Number of Correct Street Name answers	Familiarity score	Recognized Landmark	Recognized Street Name
288	15	10	5	7	2	67	5	0
289	15	4	11	4	6	33	0	0
291	15	11	4	11	2	45	3	0
293	15	7	8	6	4	58	1	2
294	14	7	7	5	7	55	2	4
296	15	5	10	5	9	81	3	7
297	15	10	5	8	3	57	4	1

4.2. Survey

4.2.1. Background

Respondents who complete the quiz game are then directed to the next step: a survey. The purpose of the survey is to distinguish high and low-context individuals.

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Of course, it would be more effective in identifying individual's cultural background if we could have conduct in-depth interviews or other qualitative methods. However, it would have been difficult to quantify the result if qualitative methods were used. Thus, a survey has been selected to allow for a stronger statistical power.

Another important reason for using a survey is that, as suggested by Straub and his colleagues (2002), each individual has complex cultural traits that cannot be strictly determined by simple demographic indicators such as nationality or gender. This led us to develop protocols that can identify individual's cultural characteristics, specifically the degree to which they tend to be high- or low-context individuals.

4.2.2. Survey Design Process

Survey protocol design began from the literature reviews. Since it involved complicated processes to generate a protocol from scratch, an extensive literature review had to be conducted to investigate if high- and low-context cultural models had been operationalized in prior studies. Even though many studies made use of surveys to identify people's cognitive aspects (Park & Sha, 2009; Herselman & van Greunen, 2011), the cultural model itself has not been materialized that much. Among the literatures found, existing multi-item measures for high- and low-context orientation (Oddou, 1999) have been modified for this study. The original questionnaire consisted of 20 questions with 5-point Likert-type scale (from 'strongly disagree' to 'strongly agree'). There were four categories of dimensions related to high- and low-context model, and each category had five questions. The original questionnaire is shown in Table 4.

Table 4. The original questionnaire (Oddou, 1999)

Item #	Time Dimension
1	I typically find myself much more preoccupied with making short-term plans (i.e. what I'm going to do this weekend) than long-term ones (i.e. what I'm planning on doing or being in several years) [reverse]
5	My natural work style is to finish one thing before moving on to the next
9	I dislike it when things don't go according to plans
13	Changing plans—even at the last minute—is no problem for me
17	It bothers me when I am later to appointments

Item #	Relationship Dimension
2	In my spare time, I am more likely to be found doing something by myself than with others
6	A commitment I have made to others is more likely to supersede one I've made to myself
10	I have several really close friends who are friends for life rather than a lot of friends who come and go in my life
14	A fair amount of my spare time is spent phoning or writing friends I don't see often
18	If I had some significant problems I needed help solving, I have any number of friends I would easily turn to for help

Item #	Space Dimension
3	I probably feel more comfortable having a clearly defined place that is mine where I can control whom I interact with
7	I feel comfortable talking about subjects like my future, my family, and so on, with most people, even if I have only know them a short while
11	Beyond knowing my first name, I consider my age, my family status, my profession (or my parent's profession) as private matters reserved for only a few close friends
15	Having a hedge or wall around my house would seem too confining to me
19	Those I term my "best friends" know just about everything about me and I would never have a problem telling them things that are very very personal

Item #	Communication Dimension
4	When someone is correcting me, I would rather the person just tell me what he or she doesn't like and not make "suggestions"
8	I prefer having things completely spelled out from the beginning than to start operating without an overview of the situation
12	I would feel more uncomfortable having a contract that doesn't list every detail pertaining to the agreement than to have some "gray" areas which would require negotiating later on
16	It is usually better to call "a spade a spade" (be direct) than to hide a situation's "true colors" (be indirect)
20	If my boss or teacher were wrong, I would be more likely to tell her or him than to simply suggest there might be another answer

An issue with the questionnaire was that there was no evidence that it had

been validated in any studies. Despite of the limitation, it was systematically

organized by providing different cultural situations, and each category of the

questions represented different concept of Hall's cultural model. This led us to make

use of the questionnaire after the validation processes. In order to examine and

validate the questionnaire, at first, a pretest was conducted for two graduate students

to test the mechanics of the protocol using think-allowed protocols. Minor

grammatical errors such as "later" in item 17 in Table 4 were detected through the

pretest, and it was also able to estimate the time it would take to conduct the survey.

This estimated time was used in recruiting phase to provide information about the

study to subjects. After the pretest, a pilot test was conducted to test the validity of the

questionnaire. Based on the analysis of the survey results, the protocols were

modified and reworded. The details of the pilot test are explained in the next section.

4.2.3. Pilot Test and Modifications

A pilot test was conducted to evaluate external and internal validity of the

adapted measures. The protocols were used without any modifications, but the scale

was modified to a 7-point Likert-scale. Some additional questions were added at the

end of the survey, asking basic demographic information such as gender, nationality,

and age. Based on the results of the pilot test and feedback, the questionnaire has

been revised. A pilot test was conducted targeting college students. The subjects for

the pilot test had been recruited mostly from an undergraduate class at the UMD

business school by rewarding them extra credits for the participation, and partially

from an online advertisement on Facebook. A total of 63 people participated in the

pilot test in December, 2013: 49 American students, 2 Vietnamese students, 2 Chinese students, 1 Korean student, and 7 Korean nonstudents. Three subjects' data were omitted in the analysis since they seemed to be answered without reading the questions: this was able to be detected by measuring the answering time for each question, and theirs were less than two seconds per question.[6]

In order to conduct a reliability test, the responses of 18 male students from the United States were used. Because, it is thought that men from Western countries were low-context individuals, so the internal reliability of the questionnaire could be found from the cultural group. The data were analyzed with SPSS. The Cronbach's alpha of their answers was -.143, which meant the questionnaire were totally unreliable for the sample. Subsequently, we conducted 2-tailed Pearson correlation to see the reliability among the questions. It showed that the 9 questions were able to be grouped together. In other words, they were reliable each other for the sample as reliability of these 9 questions was reasonable ($\alpha = .804$). The result of the reliability test is shown in Table 5. Also, subjects gave feedback about the questionnaire. For example, item 12 in Table 4 was reported to be confusing, so it has been reworded.

In order to validate the external validity of the filtered questionnaire, simple hypothesis tests had been conducted using a t-test. The first one was "U.S. female students would tend to be more high-context than male students" which was one of the explanations from the model. As shown in Table 6, females ($M=34.33$, $SD=4.81$) had higher levels of cultural scores than males ($M=30.95$, $SD=7.29$), $t(30.878) = -1.8$, $p = .081$. It was not satisfying the 5% significance level, which might be due to the small number of samples. The second hypothesis we tested was "U.S. males would

tend to be more low-context than Asian males", which is also an explanation of the model. The result rejected the null hypothesis at the 5% significance level as shown in Table 7, $t(24.990) = -2.5$, $p = .019$.

Table 5. The results of the reliability test for the selected questions.

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
VAR00001	25.6667	72.118	.509	.784
VAR00004	26.1111	74.575	.493	.786
VAR00005	26.2778	68.095	.830	.742
VAR00006	26.0556	72.879	.691	.762
VAR00009	25.8333	74.147	.678	.765
VAR00012	24.9444	81.350	.329	.805
VAR00015	24.6111	78.369	.324	.810
VAR00016	25.8889	73.399	.518	.782
VAR00020	23.9444	85.585	.204	.817

Table 6. The result of t-test: U.S. males would tend to be more low-context than U.S. females

Group Statistics

	VAR00001	N	Mean	Std. Deviation	Std. Error Mean
VAR00002	Male	20	30.95	7.294	1.631
	Female	27	34.33	4.812	.926

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means							
							Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)			Lower	Upper
VAR00002	Equal variances assumed	.658	.422	-1.916	45	.062	-3.383	1.766	-6.941	.174
	Equal variances not assumed			-1.804	30.878	.081	-3.383	1.876	-7.209	.443

Table 7. The result of t-test: U.S. males would tend to be more low-context than Asian males

Group Statistics

	Authenticity	N	Mean	Std. Deviation	Std. Error Mean
Total	Ame	18	31.0000	7.69262	1.81317
	Asian	9	36.5556	3.81153	1.27051

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means							
							Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)			Lower	Upper
Total	Equal variances assumed	.902	.351	-2.031	25	.053	-5.55556	2.73523	-11.18887	.07776
	Equal variances not assumed			-2.509	24.990	.019	-5.55556	2.21400	-10.11546	-.99565

Thus, the refined questionnaire has been used in the actual experiment. One question has been omitted from the final set of questions afterwards since the item was misleading. The survey was also implemented in Qualtrics. For the final protocols, see Appendix C.

4.2.4. Measure

The 7-point Likert-scale items are used to assess high- and low- context orientation in the questionnaires so that it can be used to construct a single measure instead of categorizing people into two distinct groups, namely, a high-context group and a low-context group. For each subject's responses, an average cultural score is calculated and this score represents the individual's tendency between high- and low-context cultures. Each individual's score from the survey is plotted against the game results. These data are analyzed with regression to determine if there is a statistically significant relationship between cultural background and spatial cognition.

4.3 Sampling

For the full study, people who had commuted to or lived in College Park more than one year were recruited. The target population is UMD students, staff, faculty members, and local citizens who have lived in or commuted to College Park. Totally, 75 people participated in the experiment through word-of-mouth, online advertisements through e-mails and SNSs, and participants' voluntary score postings on SNSs. A massive email advertisement to the UMD iSchool's mailing list was

distributed in February 2014, and a class of 20 students from the iSchool was recruited in April 2014. Subsequently, several online advertisements were distributed to the staff of the College of Arts and Humanities and to Facebook users such as UMD graduate students and Greenbelt residents.

Subjects were allowed to use any computers that were connected to the Internet in any places, and at any time they were convenient. They were asked to go to the research website[7], to read the instructions to understand how the game works, and to begin the study. After finishing the game, they saw the "Share the score" button, which allowed them to post their scores on Facebook or Twitter. Also, they saw a button that directed them to the survey site that is hosted in Qualtrics. Upon finishing the survey, they could type their email addresses in, so that they could get into a raffle. The reward for participants was a chance to get into a raffle that gave out 10 Amazon gift cards ($10 each).

The recruited samples consist of UMD students, staff, faculty members, and local citizens. The nationality composition in Figure 7 shows a good balance between Western and Asian countries. In terms of gender, the number of female subjects is 44 and that of male subjects is 31, where the proportions are about 60% and 40%, respectively. The range of age varies from 20s to 70s, but most subjects are students in their 20s and 30s reaching 78% of the total samples. The spectrum of subjects' ages is shown in Figure 8.
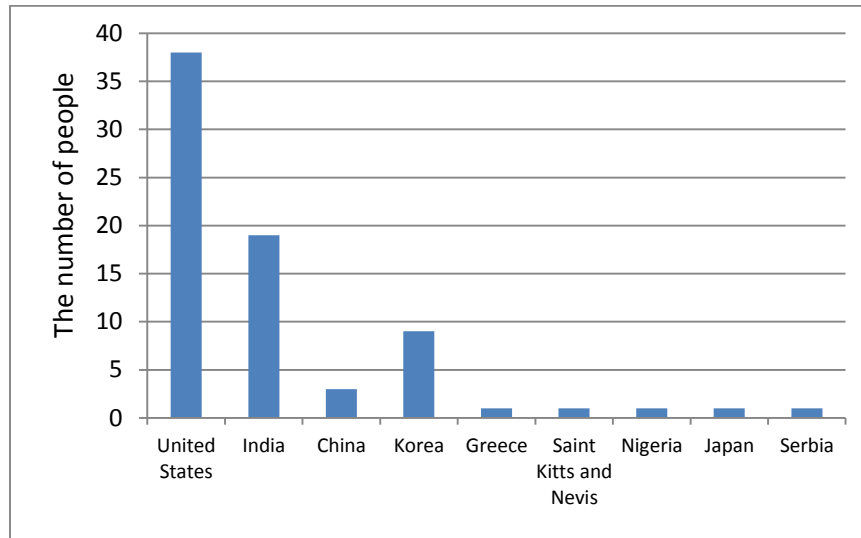
Figure 7. The composition of subjects by nationality.
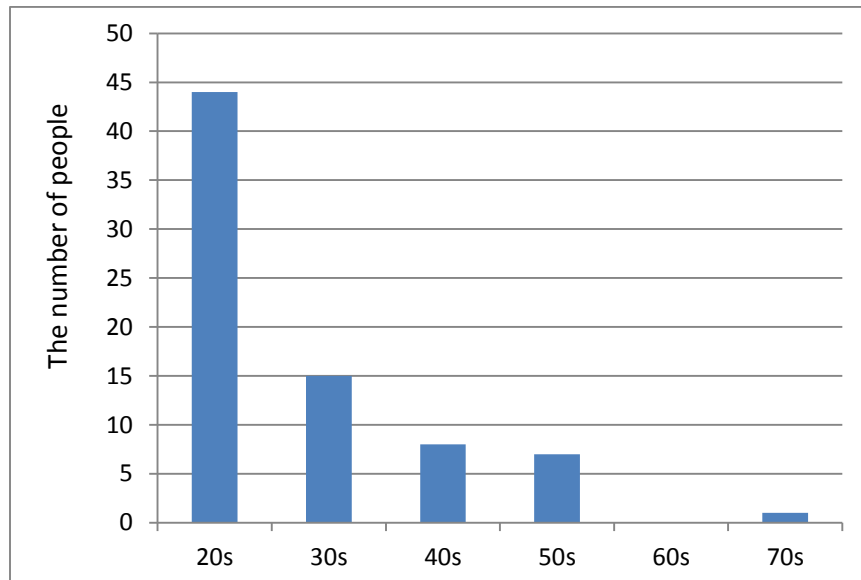
Figure 8. The composition of subjects by age.

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[1] http://urbanopticon.org

[2] Github repository: https://github.com/jpesce/urbanopticon

[3] http://ipinfodb.com

[4] Github repository: https://github.com/myeong/data_organizer

[5] A survey hosting service: http://qualtrics.com

[6] The functionality to measuring time is a feature of Qualtrics. It can basically measure the first clicking time, the last clicking time, and submitted time for each question.

[7] http://urban.myeonglee.com

Chapter 5: Analysis and Results

In this chapter, the results of the study are presented with statistical analysis. Before discussing the analysis of the data, we first look at the degree of how effective the gamification of the study is. Then, the relationship between familiarity of places and correctness is discussed. This justifies the fact that when people recognize a place, they actually feel familiar with the place. After that, we analyze the measure of cultural background. Finally, the hypothesis is tested in several ways, and data are analyzed even further for the exploration of other factors. Data are analyzed with R, an open source mathematical tool, and SPSS, a statistical tool from IBM.

5.1. Quantifiability of the Web-based Game

Actually, it is very difficult to know the accurate enhancement that comes from the gamification of the study, since we did not ask how each respondent reached to the study. Even though, it is roughly imaginable by looking at the dropout rate. A total of 125 people started the game. Among them, 111 participants completed the quiz game, so the dropout rate during the quiz game is 12%. Seventy-five participants completed the study including the survey, and the dropout rate after the quiz game is 28%. Since participants coming from people's voluntary score postings tend not to proceed to the survey, dropout rates indicate the effect of the gamification. Still, it is impossible to guess the percentage of how effective it was, since there are so many factors that affect the dropout rate. The effectiveness could be measured more accurately in the future by putting a short survey about how they knew the study.

Since people's perceptions of places is analyzed with respect to the degree of how well they recognize places in the following section, the relationship between familiarity and correctness plays a meaningful role in the discussions. If people's familiarity towards a place is highly correlated with their actual knowledge of the place, self-reported familiarity in the study can be justified to be used as an independent variable representing their recognition of the place. The relationship between the two variables is plotted in Figure 9.
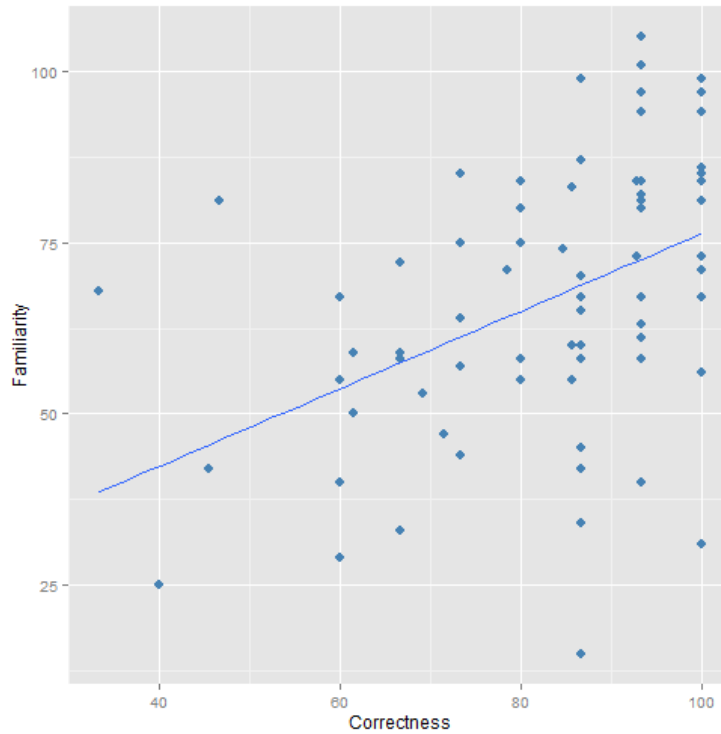
$(r = .44, p < 0.0001***)$
Figure 9. Correctness of people's answers (%) vs. people's familiarity toward places (points).

The correctness of people's answers and familiarity of places are significantly correlated, $r = .44$, $p < 0.0001$.

Since recruited samples are different from those of the pilot test, the raw data of the survey were analyzed in several ways to see if the cultural measure was still working fine. In order to see if there is more than one component of the measure, factor analysis for 75 samples has been conducted using SPSS. Table 8 shows the result of the factor analysis. The variable numbers are randomly assigned, and they match to the questions in Appendix C. As we can see, there are four main components that comprise the cultural measure. This means the cultural measure is not a uni-dimensional construct, as mentioned before, but a multi-dimensional construct. However, the classifications are slightly different from that of the original questionnaire. The descriptions of the questions show that variables 6 and 8 in Table 8 are about one's own communication style to other people. Variable 7 is also grouped with variables 6 and 8, but it is about space dimension, not about communication style. Variables 2 and 5 are grouped together meaning one's feeling towards others' communication style. Components 1 and 2 in Table 8 are all about communication style, but differentiated based on the direction of communication with others. Components 3 and 4 are meaningfully in a same group of time dimension, but somehow classified differently.

These classifications through factor analysis are used in the later analysis of the data. Although the cultural measure is found to be incomplete in each category, it has too small a number of questions to properly operationalize high-/low-context cultural models, and it would be able to explore how those cultural concepts affect people's perceptions towards places.

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**Table 8. The results of the factor analysis**

Rotated Component Matrix[a]

	Component			
	1	2	3	4
VAR00001	-.023	-.031	.776	-.090
VAR00003	.002	.030	.016	.954
VAR00004	-.043	-.019	.752	.103
VAR00002	.102	.763	-.016	.030
VAR00005	.015	.795	-.036	-.023
VAR00007	.828	.140	.032	-.166
VAR00008	.696	.127	-.096	-.016
VAR00006	.625	-.151	-.013	.305

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.707	21.336	21.336	1.707	21.336	21.336	1.572	19.655	19.655
2	1.211	15.143	36.479	1.211	15.143	36.479	1.275	15.935	35.589
3	1.129	14.112	50.591	1.129	14.112	50.591	1.179	14.739	50.329
4	1.029	12.868	63.459	1.029	12.868	63.459	1.050	13.130	63.459
5	.896	11.199	74.658						
6	.786	9.830	84.488						
7	.750	9.378	93.866						
8	.491	6.134	100.000						

5.4. Cultural Background vs. Perception of Places

In this section, we test the hypothesis for this study by using linear regression. The rates of people's landmark answers are plotted against people's scores of the survey about high-/low-context models in Figure 10. The rate of landmark answers means the number of landmark answers divided by the number of questions a respondent answered, and the cultural score means the average point of the survey answers which is in a 7-point Likert scale.
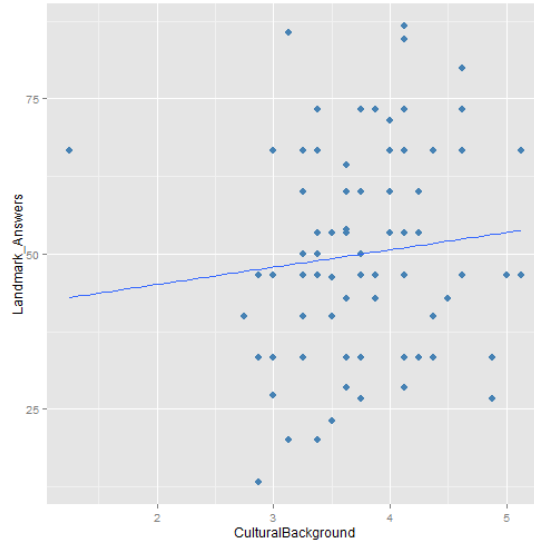
(*r* = .11, *p* = n.s.)
Figure 10. Cultural background scores (7-point scale) vs. rates of landmark answers (%).

It is failed to reject the null hypothesis (*r* = .11, *p* = n.s.). An issue with this regression

is that it does not consider people's familiarity levels toward places, which may be an

important factor in their answer types. Since familiarity level has a 7-point scale, the

cutoff point has been arbitrarily set to 4 to distinguish 'recognized places' and

'guessed places.' In other words, if a respondent's answer for a familiarity question is

equal to or greater than 4, the place is assumed to be 'recognized' by the person.

Alternatively, if it is less than 4, the place is treated as 'guessed' by the person. The

rates of landmark answers among answers with the familiarity level greater than or

equal to 4 are plotted against each person's average cultural score in Figure 11. The

regressions show that the relationship between the two variables is not significant

regardless of familiarity levels, so it rejects the null hypothesis for the given samples.
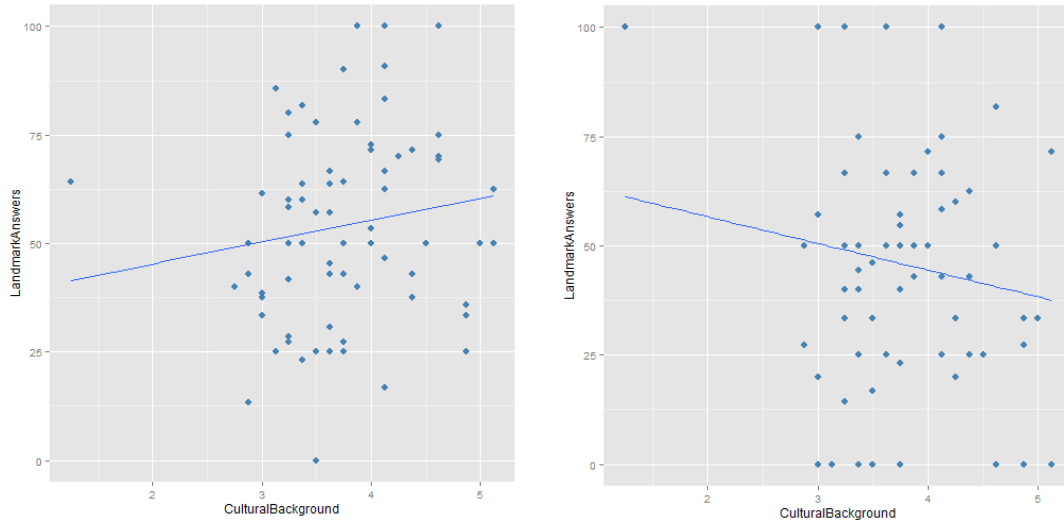
(a) When places are recognized
*(r = .15, p = n.s.)*

(b) When places are guessed
(r = .14, p= n.s.)

**Figure 11. Cultural background scores vs. rates of landmark answers,
when familiarity level is considered (familiarity level ≥ 4).**

Meanwhile, what happens if the cutoff point of familiarity level changes? Figure 12 depicts the changes of the significance levels. When the cutoff point changes from 4 to 5, the p-value of the regression changes from .21 to .11 (even though the change might be meaningless and both are not significant). When the cutoff point changes to 6, however, the significance level reaches the marginal, $p = .10$. This implies that people's perceived familiarity might be biased to some degree. However, there can be other causes that reduce the p-value such as saturation effects of the data, so the statistical power is still not strong.
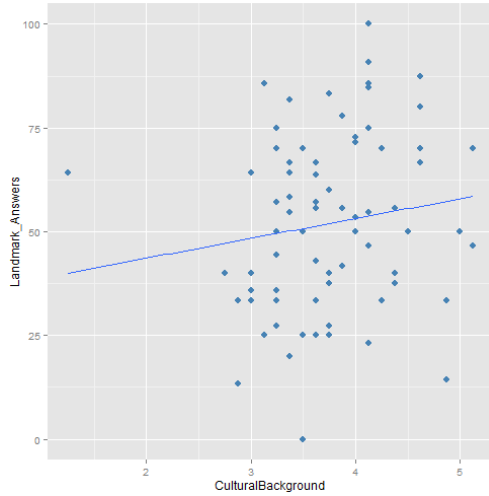
(a) Familiarity $\geq$ 3 ($r = .15, p = .21$)
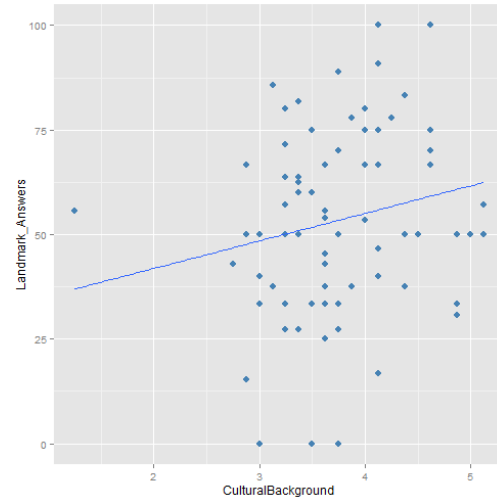
(b) Familiarity $\geq$ 5 ($r = .19, p = .11$)
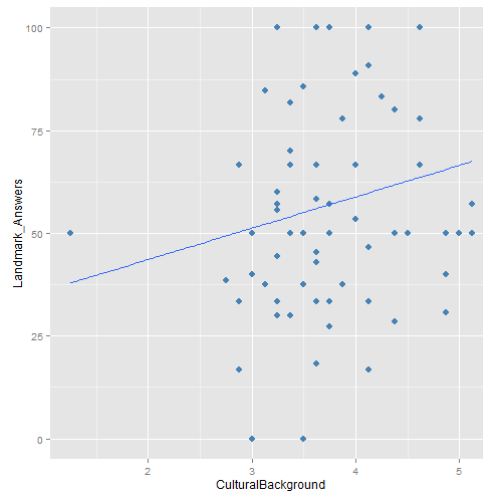
(b) Familiarity $\geq$ 6 ($r = .20, p = .10*$)

Figure 12. Cultural background vs. the rate of landmark answers for recognized places, when the cutoff point of familiarity levels changes.

5.5. Place Effect

It is possible that photos of some specific places can have some degree of effects on the rate of answer types. For example, if a place is famous just like the White House in Washington D.C., subjects' responses can be biased to 'landmark' rather than the street name of the place. This kind of biases has been detected in the

data set. Figure 13shows the rate of landmark answers per each place. Index numbers of photos on x-axis of the graph are randomly assigned in the database, and the order of the bar graphs is sorted by the rate. Photos with red boxes are biased ones more than 20% from the even point. If we eliminate the place and photo effects, the results might be different. We thus conducted the analysis without the data from the biased places. The results are shown in Figure 14. The cutoff point for recognized places is now set to 5, since the previous analysis in Figure 12 shows that it makes more sense to set it to 5 for determining people's ability to recognize places. Even after the biased photos are removed, however, the results are not statistically significant. A potential implication is the fact that more places are needed to minimize the effect of places. It is because there are a number of saturated data such as 0% and 100% of landmark answers after omitting biased places. The saturations of data can affect the result of regression, and mostly due to the small number of places: only 8 places are used for the analysis. This indicates that more places need to be added and tested in future studies, so that we can have undistorted and fine-grained dataset.
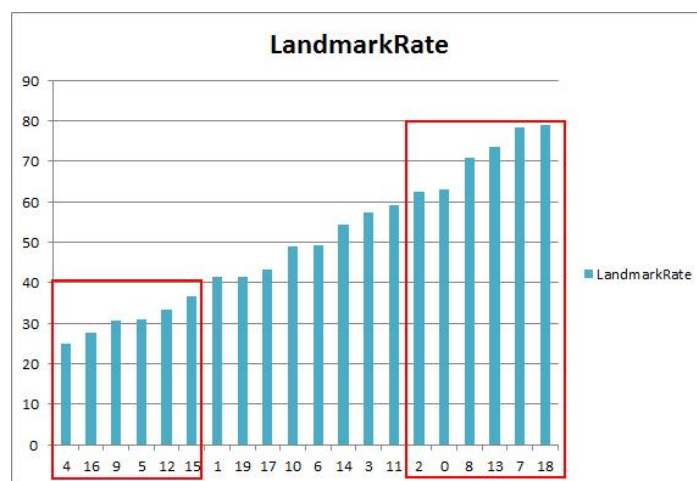
Figure 13. The rate of landmark answers for each image.

(a) Familiarity not considered,
($r = .05, p = $ n.s.)
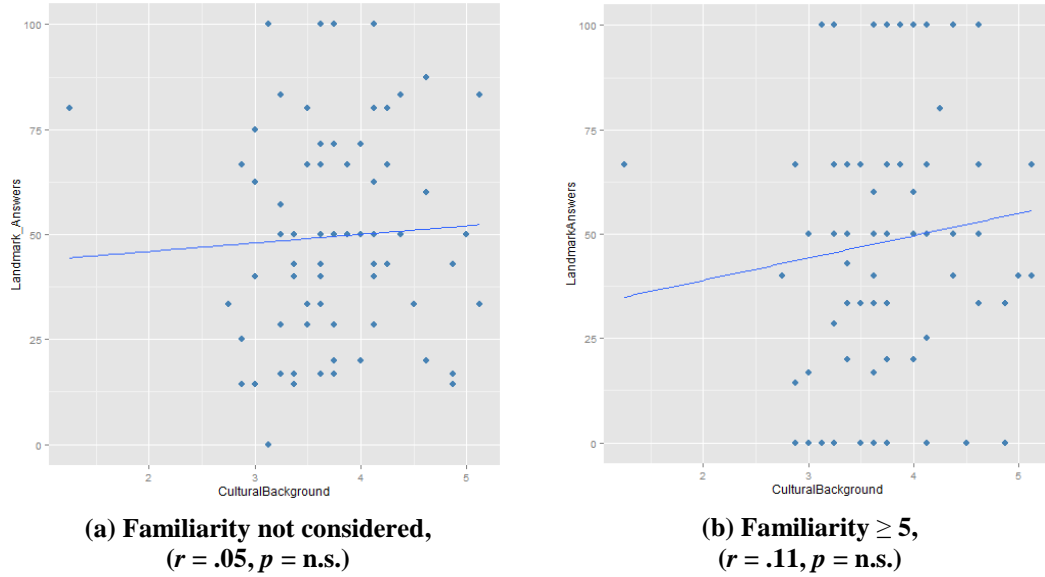
(b) Familiarity $\geq$ 5,
($r = .11, p = $ n.s.)

Figure 14. Cultural background scores vs. the rate of landmark answers,
without photos that are biased more than 20%.

5.6. Considering Multiple Dimensions of Cultural Background

The survey consists of multiple dimensions of cultural measures as identified in section 5.3. It was able to detect meaningful classifications through a factor analysis. The components were time dimension, space dimensions, one's communication style, and one's attitude towards others' communication style. Based on cultural scores from each category, the data are analyzed by using regression for recognized places (familiarity $\geq$ 5). The results are shown in Figure 15. The graphs show that one's communication style toward others and time dimension do not matter in people's perception of places for this population. In Figure 16, the rates of landmark answers are plotted against scores of one's attitude towards others' communication style, for recognized places.
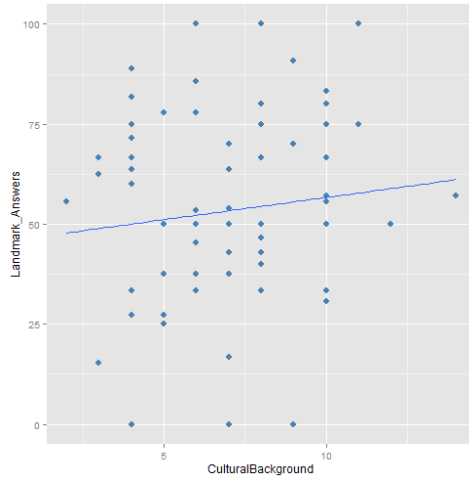
(a) One's communication style to others
($r = .12, p$ = n.s.)
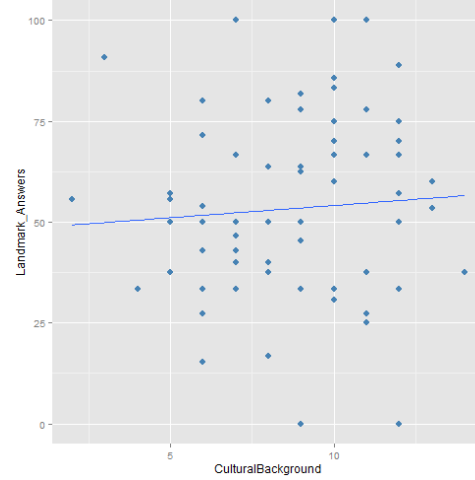
(b) Time dimension
($r = .07, p$ = n.s.)

Figure 15. Regressions for one's communication style and time dimension (familiarity level ≥ 5).
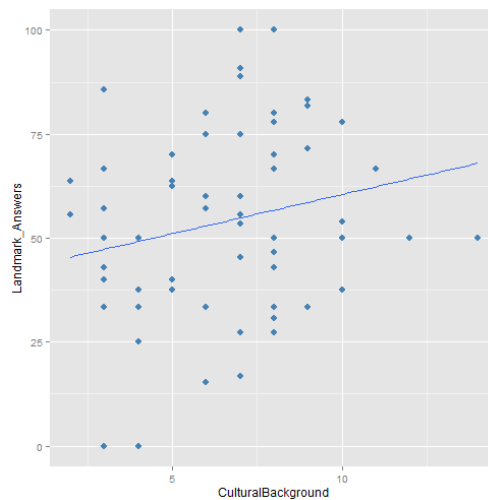
($r = .21, p = .075*$)
Figure 16. One's attitude toward others' communication style vs. the rate of landmark answers (familiarity ≥ 5).

When cultural background comes to one's attitude toward others' communication styles, it rejects the null hypothesis at 10% significance level. Since there are only two questions that measure one's attitude to others' communication styles, it cannot be said that this construct is a powerful operationalization of high-/low-context

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culture. However, the finding can provide a meaningful implication: the direction of

communication style might matter in people's perception of places in a way that

one's attitude toward others' communication styles might be more effective than his

or her own communication practices.

Chapter 6: Discussion

Overall, the experiment has failed to reject the null hypothesis. There can be several points that can enhance the experiment. First, the sample size needs to be larger. The first pilot test for the survey targeted 60 students, and 75 participants were recruited for the actual test. However, 60 students may not enough for conducting factor analysis and reliability test in the pilot test. Also, 75 participants can be small in examining cultural background and perceptions, since cultural background is a multi-dimensional construct with high uncertainty. Another issue rises from the number of protocols and quizzes. Since the questionnaire had only eight questions that were adjusted from Oddou's questionnaire, it might not be able to operationalize the cultural model in the way that it differentiated peoples' responses properly. Quizzes, in addition to the questionnaire, need to be iteratively refined so to filter out biased places, and to cover as many places as possible. Of course, there is no 'appropriate' number of data that guarantee a successfully study, but it is known that both an actual experiment and a factor analysis in a pilot test could be done reasonably with more than 150 subjects, respectively. Even though, it would be worth exploring the data in different ways in terms of finding other meaningful implications for the future research. In following sections, therefore, we conduct some more analysis of the data using demographic information that might be related to either people's familiarity of places or their perceptions of a place.

6.1. Further Analysis

Analysis of variance (ANOVA) has been conducted to see whether people's perception of places, i.e. the rate of landmark answers, is dependent on any demographic information. Figure 17 shows the effect of gender on the rate of landmark answers (familiarity ≥ 5). The main effect of gender was not significant in differentiating the tendency how people perceive places, $F(1, 73) = 1.04$, p=n.s. When comparing this result to the one from the pilot test in Table 6, it is probable that other factors might affect the result. Since several factors, i.e. age (20s), major (business), nationality (U.S.), were controlled in the pilot test, the quality of data might have been better before, despite the small sample size.

In Figure 18, we try to figure out if age matters in the rate of landmark answers (familiarity ≥ 5). Perception of places is also not systematically differentiated by the effect of age, $F(4, 66) = 0.9$, p = n.s. Since the number of older people is very small, a further study needs to be done to identify the age effect by recruiting people from diverse age groups.
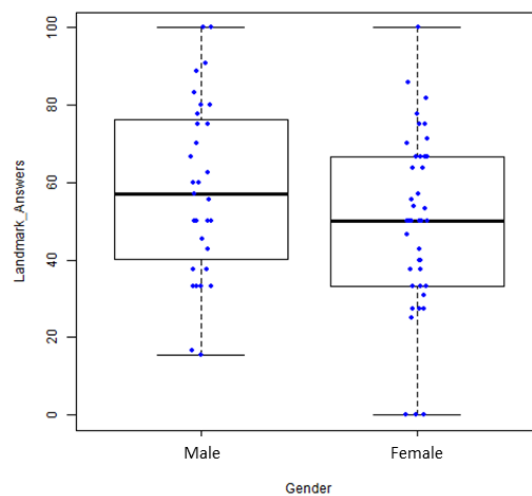
($F(1, 73) = 1.04$, p=n.s.)
Figure 17. Gender vs. the rate of landmark answers (%).
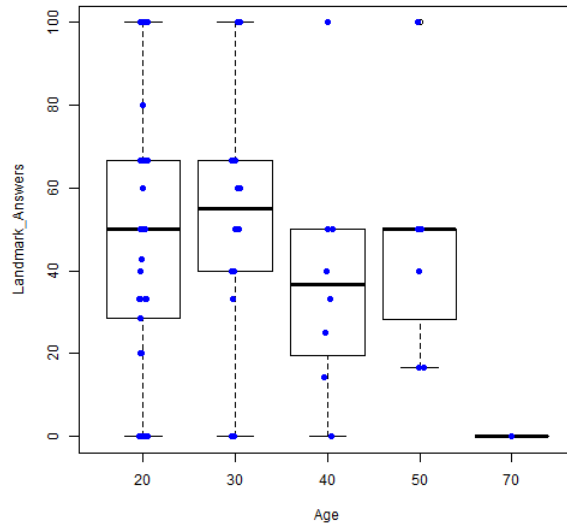
$(F(4, 66) = .9, p = \text{n.s.})$
Figure 18. Age vs. the rate of landmark answers (%).
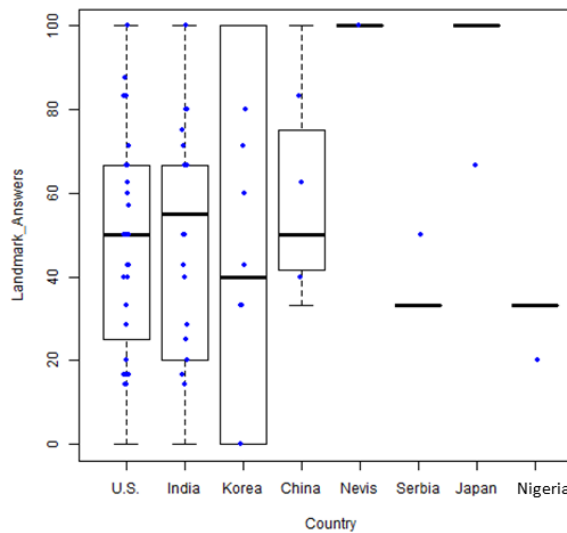
$(F(7, 61) = .89, p = \text{n.s.})$
Figure 19. Country one had lived most vs. the rate of landmark answers (%).

Rates of landmark answers are plotted against countries that people had (or have) lived most in Figure 19 (familiarity $\geq$ 5). Again, people's perception of places was not differentiated due to the effect of countries people had lived most, $F(7, 61) = .89$, $p = \text{n.s.}$ For countries with a small number of subjects such as China, Saint Kitts and Nevis, or Serbia, more people would need to be recruited to test the tendency.

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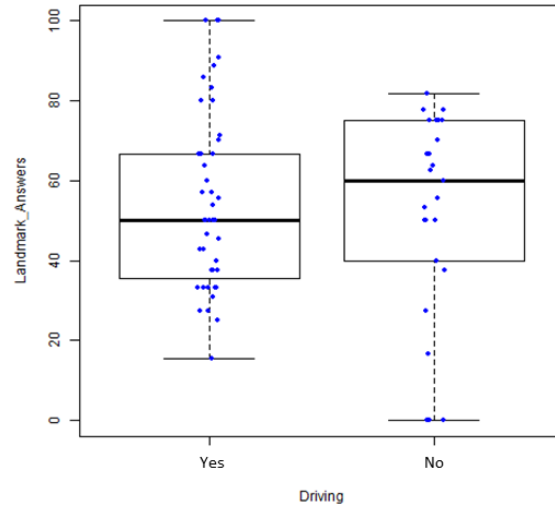
$(F(1, 70) =.09, p = \text{n.s.})$
Figure 20. Driving experience in College Park vs. the rate of landmark answers (%).

Lastly, people's driving experiences in the city of College Park was not effective in making systematical variations among their perception of places as shown in Figure 20, $F(1, 70) = 0.09$, $p = \text{n.s.}$

Another interesting dependent variable to see is people's familiarity level toward places. If researchers can have an insight about how people become familiar with a place, it would be also meaningful in providing design implications for Geo-local systems. One noteworthy factor that was effective in people's familiarity level was one's driving experience in College Park as shown in Figure 21, $F(1, 73) = 6.22$, $p = .015$. This implies that driving a car in a place can affects people's familiarity level by providing them more chances to experience parts of a city. The reason why it affects their familiarity, however, needs to be explored in future studies.

The main effects of other demographic information were not significant for this population about people's familiarity level: country lived most ($F(7, 65) = .38$, $p = \text{n.s.}$), age ($F(4, 70) = 1.57$, $p = \text{n.s.}$), gender ($F(1, 73) = 1.04$, $p = \text{n.s.}$).

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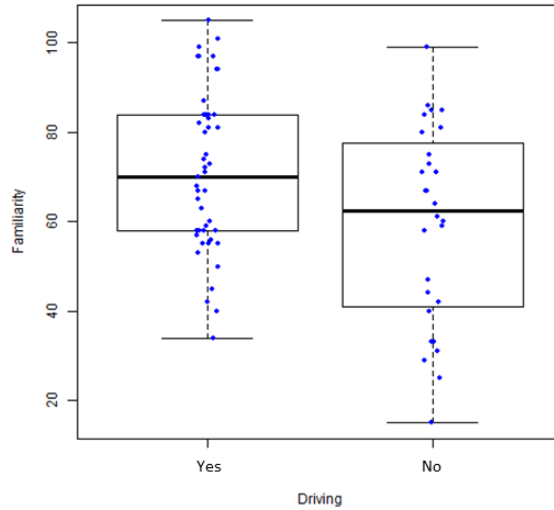
F(1, 73) = 6.22, p = .015**
Figure 21. Driving experience in College Park vs. level of familiarity (Likert-scale points).

6.2. Potential Impact and Limitations

This study can provide design implications for designers, researchers, and developers of Geo-local systems in the way that they consider users' high-/low-context cultural traits. Actually, the approach of this study has a fundamental difficulty in order for being used by designers. It is because this study tries to examine people's cultural background on an individual level, while social computing systems, particularly Geo-local systems, are mostly designed for the group level. Since it is a very hard problem to consider individual-level variations among people in designing a system, many designers adopt a strategy to target specific groups that can be distinguished by tangible boundaries that are, for instance, geographical or educational. However, there have been technologies and studies that imply future possibilities of controlling individual-level data and providing customized interfaces for users (Bachrach et. al., 2012; U.S. Patent No. 8,027,874, 2011). Using these technologies and research results, famous IT companies such as Google, Facebook,

and Amazon are continuously making use of users' behavior patterns on their websites (and even on web browsers), for providing customized advertisements to each user. If these technologies take high-/low-context concepts into account, it would be possible to make use of the result of this study in providing culturally-customized interfaces, which eventually would enrich system users' information practices. For example, as Kim designed an advertisement in his study, it would be possible to present a webpage with high- and low-context designs (Kim, 2013). If a Geo-local system detects each user's reading time for a specific content, for example a picture of a place, the system can make use of the data for determining the user's cultural background. Then, cultural tendency of the user can be fed back into his/her interfaces in the application. Of course, this scenario is a very simple example without a technical logic, but modern technologies give us an enough implication that individual-level cultural traits are able to be identified.

As with any empirical study, this work has additional limitations that must be addressed. Landmarks and street names, in general, and answer types, specifically, are only indicators of individuals' perceptions of a place. There can be many other ways of perceiving places, and in-depth interviews in future studies will help validate the model and its operationalization. Also, the public nature of the survey and games may result in frivolous respondents and a high dropout rate. In order to deal with this, subjects can be notified about how long it takes, a warm-up phase can be inserted in front of the survey, and an explanation of the research can be provided (Reips, 2000). Also, targeted recruiting methods can be considered so that the risk of spurious and insincere participation can be minimized.

Additionally, since road conditions, traffic policies, and addresses vary among countries, results may be dependent on people's home countries. This can be a critical disturbing factor in this study. Developing protocols and analysis methods that combines these factors would also beneficial in constructing a more precise measure.

Last, future studies about this topic need to be more cautious in using the concepts of recognition, perception, memory, reference, and recall. Some of these concepts are used interchangeably in parts of this study, but actually they are all different terms and need to be distinguished. What we tried to measure was in fact people's references of places, and it would have been more accurate if their perceptions were inferred from the analysis of their referencing practices.

Chapter 7: Conclusion

This work tries to answer a fundamental question on how people adapt to new urban areas. Since newcomers have to deal with not only adjusting to different culture and society, but also learning new places, well-designed information strategies are crucial in guiding and helping them. In order for the success of the strategies and designs of Geo-local systems, it is one of critical knowledge bases to understand individuals' perceptions and information behaviors regarding geospatial places. By clarifying how cultural background influences people's perceptions of places, this research will be able to provide basic concepts to be considered to researchers, city planners, developers, and governors, so that they can design better Geo-local systems or strategies for newcomers. Even though it is not easy to measure cultural characteristics and human perceptions, the identifying processes are designed in ways to quantify cultural model and perception of a place. Also, in discussion, we showed a possibility for making use of this individual-level concepts in actual systems by presenting an example. Despite the failure of rejecting the null hypothesis, this study provides meaningful implications for further research.

Appendix A: Murdock's Universal Cultural Values (1965)

Age-Grading	Language
Athletic Sports	Law
Bodily Adornment	Luck Superstitions
Calendar Law	Marriage
Cleanliness Training	Mealtimes
Cooking	Medicine
Cooperative Labor	Modesty about
Cosmology	Natural Functions
Courtship	Mourning
Dancing	Music
Decorative Art	Mythology
Divination	Numerals
Division of Labor	Obstetrics
Dream Interpretation	Penal Sanctions
Education	Personal Names
Eschatology	Population Policy
Ethics	Postnatal Care
Ethno botany	Pregnancy Usages
Etiquette	Property Rights
Faith Healing	Propitiation of Supernatural beings
Family	Puberty Customs
Feasting	Religious Ritual
Fire Making	Residence Rules
Folklore	Sexual Restrictions
Food Taboos	Soul Concepts
Funeral Rites	Status Differentiation
Games	Surgery
Gestures	Tool Making
Gift Giving	Trade
Government	Visiting
Greetings	Weaning
Hair Styles	Weather Control
Hospitality	
Housing	
Hygiene	
Incest Taboos	
Inheritance Rules	
Joking	
Kin-Groups	
Kinship Nomenclature	

Appendix B: Locations in the Web-based Game

ID	Landmarks	Street Name
0	In front of University View APT	Near Baltimore Ave and Berwyn House Rd.
1	In front of College Park Shopping Center	Near Baltimore Ave and Knox Rd.
2	Near Graduate Hills APT	Near Adelphi Rd and Campus Dr.
3	Near UMD Fire and Rescue Institute	Near Paint Branch Parkway
4	North of University of Maryland	Near University Blvd E and Metzerott Rd.
5	Near Shoppers and BestBuy	Near Cherry Hill Rd and Baltimore Ave.
6	In front of IKEA	Near Ikea Center Blvd and Baltimore Ave.
7	Near the Main Gate of Univ of Maryland	Near Campus Dr and Baltimore Ave.
8	In front of College Park Metro	Near Paint Branch Pkwy and River Rd.
9	In front of Westchester Park Apartments	Near Route 201 and Westchester Park Dr.
10	Near Hollywood Plaza (shopping center)	Around Edgewood Rd and Rhode Island Ave.
11	Near Giant (grocery store)	Near Cherrywood Ln and Greenbelt Rd.
12	Near Berwyn Heights Elementary School	Near Quebec St and 62nd Ave.
13	Near Entrance to UMD Golf Course	Near University Blvd E and Stadium Dr.
14	Near Wallace Presbyterian Church	Near Metzerott Rd and Greenmead Dr.
15	Near United States Post Office (USPS Office)	Near Baltimore Ave and Hollywood Rd.
16	Near Branchville Volunteer Fire station	Near University Blvd E and Rhode Island Ave.
17	Near College Park Volunteer Fire Department	Near Baltimore Ave and Melbourne Pl.
18	Near Fraternity Row	Around Yale Avenue
19	Near Soronity Row	Near Yale Ave and Knox Rd.

Appendix C: Final Protocols

* The item numbers are randomly assigned to questions when implemented in Qualtrics, and match to the item numbers in chapter 5.

Communication style to other people

6. It is usually better to call "a spade a spade" (be direct) than to hide a situation's "true colors" (be indirect).

8. If my boss or teacher were wrong, I would be more likely to tell her or him than to simply suggest there might be another answer.

One's feeling towards others' communication style

2. When someone is correcting me, I would rather the person just tell me what he or she doesn't like and not make "suggestions."

5. I would feel more uncomfortable having a contract that doesn't list every detail pertaining to the agreement than to have some "gray" areas which would require negotiating later on.

Time dimension

1. I typically find myself much more preoccupied with making short-term plans (i.e., what I'm going to do this weekend) than long-term ones (i.e., what I'm planning on doing or being in several years).

3. My natural work style is to finish one thing before moving on to the next.

4. I dislike it when things don't go according to plans.

Space dimension

7. Having a hedge or wall around my house would seem too confining to me.

Demographic information
- Gender
- Age
- Ethnicity

- Country one lived most
- Driving experience in College Park

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